Pramana – journal of physics

Volume 51
1998

Published by
Indian Academy of Sciences
Bangalore 560 080

Pramana – journal of physics

Editor

H R Krishnamurthy
Indian Institute of Science, Bangalore

Associate Editor

Rohini M Godbole
Indian Institute of Science, Bangalore

Editorial Board

J K Bhattacharjee, *Indian Assoc. for the Cultivation of Science, Calcutta*
Neelima Gupte, *Indian Institute of Technology, Chennai*
S Kailas, *Bhabha Atomic Research Centre, Mumbai*
Dilip G Kanhere, *University of Pune, Pune*
A V Khare, *Institute of Physics, Bhubaneswar*
C Manohar, *Bhabha Atomic Research Centre, Mumbai*
Deepak Mathur, *Tata Institute of Fundamental Research, Mumbai*
S Mohan, *Central Scientific Instruments Organization, Chandigarh*
Debashis Mukherjee, *Indian Assoc. for the Cultivation of Science, Calcutta*
Sunil Mukhi, *Tata Institute of Fundamental Research, Mumbai*
Rajaram Nityananda, *Raman Research Institute, Bangalore*
R Ramaswamy, *Jawaharlal Nehru University, New Delhi*
A K Raychaudhuri, *National Physical Laboratory, New Delhi*
K C Rustagi, *Centre for Advanced Technology, Indore*
E V Sampathkumaran, *Tata Institute of Fundamental Research, Mumbai*
Abhijit Sen, *Institute for Plasma Research, Gandhinagar*
Dinesh Sharma, *Indian Institute of Technology, Mumbai*
R Simon, *Institute of Mathematical Sciences, Chennai*
K Subramanian, *National Centre for Radioastronomy, Pune*
C S Sundar, *Indira Gandhi Centre for Atomic Research, Kalpakkam*

Editor of Publications of the Academy

N Mukunda
Indian Institute of Science, Bangalore

Annual Subscription Rates

All countries except India (Price includes AIR MAIL charges)	US$ 200
India	Rs. 200

Annual subscriptions for individuals for India and abroad are Rs. 100/- and $50 respectively.

All correspondence regarding subscription should be addressed to the Circulation Department of the Academy

---

Editorial Office

Indian Academy of Sciences, C V Raman Avenue,
P.B. No. 8005, Bangalore 560 080, India

Telephone: 80-334 2546
Telefax: 91-80-334 6094

Website: http://www.ias.ernet.in

Email: pramana@ias.ernet.in

© 1998 by the Indian Academy of Sciences. All rights reserved.

"Information for contributors" is printed in the last issue of every volume.

Pramana – journal of physics

CONTENTS – VOLUME 51 (July–December 1998)

Numbers 1 and 2

Special Issue on Proceedings of the 5th Workshop on High Energy Physics Phenomenology

Obituary note 1

Preface 5

Higgs and SUSY searches at LHC . . . . . *D P Roy* 7

The Inflationary universe – From theory to observations . . . . . *Varun Sahni* 27

Heavy-ion collisions . . . . . *Sourendu Gupta* 39

Symmetries of the standard model without and with a right-handed neutrino . . . . . *Ernest Ma* 45

Neutrino masses and mixing in the light of experimental data . . . . . *S M Bilenky, C Giunti and Walter Grimus* 51

Tevatron: Recent results and prospects at the upgrade . . . . . *Naba K Mondal* 65

Recent results from large electron positron collider. . . . . *S Banerjee* 77

Particle dark matter physics: An update. . . . . *Manuel Drees* 87

Recent results from HERA . . . . . *Jörg Gayler* 107

An introduction to explicit R-parity violation . . . . . *Herbi Dreiner* 123

Astrophysical constraints on superlight gravitinos. . . . . *J A Grifols* 135

Charmonium production at high-energy colliders . . . . . *Michael Kramer* 145

Theoretical understanding of direct photon production . . . . *Michel Fontannaz* 157

Particle mass limits in minimal and nonminimal supersymmetrical models . . . . . *P N Pandita* 169

Observable signals of gauge-mediated super-symmetry breaking . . . . . *B Mukhopadhyaya* 181

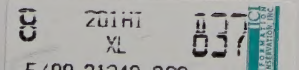
Topological defects and cosmology. . . . . *Robert H Brandenberger* 191

Low x physics and structure functions. . . . . *Rahul Basu* 205

Resolved photon processes. . . . . *R M Godbole* 217

Astrophysical constraints on particle properties . . . . . *Subhendra Mohanty* 229

Quantum SUSY signatures in low and high energy processes. . . . . *Joan Sola* 239



Physics at the linear collider . . . . . *Fawzi Boudjema* 249

Astroparticle physics: Working group report . . . . . *Subhendra Mohanty and Varun Sahni* 273

B physics and collider physics: Working group report . . . . . *Amitava Datta and B Mukhopadhyaya* 287

Quantum chromodynamics: Working group report . . . . . *K Sridhar* 297

Beyond the standard model: Working group report . . . . . *Debajyoti Choudhury and Saurabh D Rindani* 305

List of participants 313

Numbers 3 & 4

Review

Charges in gauge theories . . . . . *Robin Horan, Martin Lavelle and David McMullan* 317

Research Articles

Gravitationally induced particle creation in a q-scalar field . . . . . *G Vinod and K Babu Joseph* 357

Correct bound states of the non-linear oscillator through non-variational method: Failure of the variational method . . . . . *Biswanath Rath* 365

String cosmology in inhomogeneous cylindrically symmetric spacetime . . . . . *Subenoy Chakraborty and Anusua Roy* 369

Existence of multiple attractors and the nature of bifurcations in a discontinuous logistic map . . . . . *P R Krishnan Nair and V M Nandakumar* 377

CP-violating dipole form factors of the top quark and tau lepton in scalar leptoquark models. . . . . *P Poulose and Saurabh D Rindani* 387

Nonlinear effects on Nielsen–Olesen instability . . . . . *Vishnu M Bannur* 405

Aspects of Planckian scattering beyond the eikonal . . . . . *Saurya Das and Parthasarathi Majumdar* 413

ΛN Space-exchange effects in the s-shell hypernuclei and ${}^{9}_{\Lambda}\mathrm{Be}$ . . . . . *Mohammad Shoeb, Q N Usmani and A R Bodmer* 421

Investigation of two- and three-nucleon transfer reactions in ${}^{12}\mathrm{C} + {}^{56}\mathrm{Fe}$ . . . . . *Hari S Patel, B Srinivasan, B J Roy and M G Betigeri* 433

On the Wigner–Witmer correlation rules for a homonuclear diatomic molecule with the like atoms in identical atomic states . . . . . *V P Bellary, T K Balasubramanian and B J Shetty* 445

Total electron scattering cross-sections for carbon monoxide at low electron energies . . . . . *P Rawat, K P Subramanian and Vijay Kumar* 453

Design considerations and scaling laws for high power convective cooled CW CO_2 lasers . . . . . *A K Nath and V S Golubev* 463

Amplification of extra-ordinary mode wave in the presence of kinetic Alfvén wave turbulence . . . . . *B K Saikia, B J Saikia, K S Goswami and Bujarbarua* 481

On a class of three-dimensional corner eddies . . . . . *P N Shankar* 489

Magnetic anomolies in Gd_2PdSi_3 . . . . . *R Mallik, E V Sampathkumaran, P L Paulose, H Sugawara and H Sato* 505

Dielectric properties of electrolytic solutions . . . . . *V V Navarkhele, R S Agarwal and M L Kurtadikar* 511

3-d Model for strain ordering in steel: I Static effects . . . . . *S K Ghoshal and S Dattagupta* 519

3-d Model for strain ordering in steel: II Relaxational effects. . . . . *S K Ghoshal and S Dattagupta* 539

Number 5

Special Issue on Proceedings of the Workshop on Foundations of Quantum Theory

Preface 547

Interpretation of quantum mechanics and quantum measurement

The Ithaca interpretation of quantum mechanics. . . . . *N David Mermin* 549

Measurement problem in quantum mechanics: Characteristics of an apparatus . . . . . *Deepak Kumar* 567

Hindered decay of an unstable system: A quantum zeno effect . . . . . *Saverio Pascazio and Larry S Schulman* 577

Causal quantum theory

de Broglie–Bohm formulation of quantum mechanics, quantum chaos and breaking of time-reversal invariance . . . . . *F H M Faisal and U Schwengelbeck* 585

Maximally causal quantum mechanics. . . . . *S M Roy* 597

Tunneling time based on the quantum diffusion process approach in multichannel and optical potential cases . . . . . *Ichiro Ohba, Kentaro Imafuku and Yoshiya Yamanaka* 603

Decoherence

The structure of the quantum mechanical state space and induced superselection rules . . . . . *Joachim Kupsch* 615

Energy basis via decoherence . . . . . *Anu Venugopalan* 625

Quantum optics

Quantum correlations in optics . . . . . *R Ghosh* 633

Hierarchies of non-classical states in quantum optics . . . . . *N Mukunda* 643

Wave-particle duality: The mystery keeps unfolding . . . . . *Partha Ghose* 651

Number 6

Spherically symmetric static solutions of the Einstein–Maxwell equations . . . . . *J Krishna Rao and M M Trivedi* 663

Collapsing void in flat space Robertson–Walker universe . . . . . *D R Mandal and S Banerji* 673

Motion of test particle around global monopoles in Brans–Dicke theory . . . . . *Subenoy Chakraborty and Md. Farook Rahaman* 689

Physical nature of the event horizon . . . . . *Jagannath Thakur* 693

Einstein equations and the joining of discontinuous metrics . . . . . *Jagannath Thakur* 699

Mass and decay constant of the $(q\bar{q})$-pion in a relativistic-potential model of independent quarks . . . . . *S N Jena, M R Behera and S Panda* 711

$T = 0$ versus $T = 1$ pairing in $O(36)$ limit of IBM-4 for heavy $N = Z$ nuclei . . . . . *V K B Kota* 727

Vertex function and coupling constant for the virtual decay of ^{7}Li . . . . . *V K Sharma* 733

Near-barrier fusion reactions induced by α on ^{197}Au, ^{193}Ir, ^{191}Ir, ^{185}Re, ^{181}Ta, ^{121}Sb and ^{69}Ga nuclei . . . . . *M Ismail* 743

Calculation of triple differential cross-sections of K-shell ionization of medium-heavy atoms by electrons for symmetric geometry . . . . . *J N Das and S Dhar* 751

Possibility of weakly charged non-linear solitary dust clouds near the continuum threshold of dust population in a quasi-neutral dusty plasma . . . . . *S K Baishya, Joyanti Chutia, M K Kalita, G C Das and B Dwivedi* 757

Subject Index 773

Author Index 777

Volume Contents i

Pramana – journal of physics

Information for contributors

Pramana – journal of physics welcomes articles communicating current research work in physics, which will be published subject to acceptability after referee and editorial assessment. Articles may be submitted under any of the following categories:

(1) **Research papers:** Normal full length papers which describe significant and substantial original work. These should not normally exceed 8000 words or equivalent in length.

(2) **Rapid Communications:** This will be processed faster by the journal. A need for urgent publication, as judged by our referees and editors, will be an important additional criterion in the acceptance of such contributions. The paper should describe the work concisely, being not longer than 2500 words or equivalent. A longer article, containing full details of the same work, can be separately entertained under category (1) above– (research papers).

(3) **Comments:** Comments on papers which have already appeared in *Pramana*, or **addenda** and **errata** to such papers by the authors themselves. These could be as short as a paragraph, but not ordinarily longer than 1000 words or equivalent.

(4) **Brief reports:** These should be short articles (less than 2500 words or equivalent) making specific technical points of interest to others in the area, even though the content may not be substantial enough to be considered under category (1).

Review articles: In addition to the different categories of papers mentioned above, *Pramana* now publishes review articles. These are by invitation and represent a scholarly review of an area of physics, with substantial references to the existing literature in the field. The invitations are generally initiated by the Editorial Board. However, any author(s) with ideas for a potential review article are welcome to communicate to the Editors a synopsis and a detailed plan of the proposed review. This will be assessed and if found acceptable an invitation to contribute a review could result. All review articles are still refereed after their submittal.

Pramana also intends to publish topical reviews which are not necessarily comprehensive but represent a particularly interesting or important viewpoint (even if it is not universally accepted) since such articles can stimulate further work.

Authors wishing to have papers published in *Pramana* in any of the above categories should send them to the Editorial Office.

Three copies of the paper must be submitted.

The submission of a paper by a set of authors will be held to imply that it represents the results of their original research not previously published; that

it is not under consideration for publication elsewhere; and that if accepted for *Pramana* it will not be published elsewhere.

Typescript: Papers must be written clearly and concisely in English, the preferred spelling being that of the Concise Oxford Dictionary. They must be typed double spaced with ample margin on all sides on white bond A4 size paper, (297×210 mm). This also applies to the abstract, tables, figure captions and the list of references each of which are to be typed on separate sheets.

Title Page: The first page must bear **a**) title of the paper **b**) the initials and the names of the authors **c**) names and addresses of the institutions where the work was carried out **d**) the permanent or present addresses of the authors, (if different from c) and **e**) the Physics and Astronomy Classification Scheme Number for the manuscript. A copy of the scheme can be obtained from the Editorial Office. Authors should suggest an abbreviated running title of not more than 50 characters including spaces. The title must be specific and should contain words useful for indexing.

Abstract: All papers must have an abstract of not more than 200 words. The abstract should indicate the general scope of the paper, the important findings and the conclusions drawn.

Keywords: Between 3 and 6 keywords must be provided for indexing and information retrieval services.

List of Symbols: In cases where the number of symbols used is large, the authors should attach to the manuscript a separate complete list of symbols identified typographically, not mathematically. This list will not appear in print but is essential in order to avoid costly corrections at the proof stage. In other cases, a clear typographical identification of each symbol, made in the margin in quotes (e.g. "epsilon") the first time it appears in the text should be adequate.

Text: The paper must be divided into sections starting preferably with "Introduction" and ending with "Conclusions". The main sections should be numbered 1, 2, 3 etc and subsections 2.1, 2.2 etc.

Tables: All tables must be numbered consecutively in Arabic numerals (not Roman) (e.g. Table 3) in the order of appearance in the text. The tables should be self-contained and have a descriptive title. Column headings of tables should be brief. Extensive tables will be reproduced photographically and should therefore be typed carefully and in the exact format desired. Footnotes to the tables, if any, should be identified by superscript symbols and placed at the bottom of the page containing the table.

Footnotes: Footnotes to the text should be avoided if possible. When necessary they should be numbered along with the references (numbers in square brackets) sequentially in the main text. The matter of each footnote should appear after the appropriate number in the list of references.

Appendices: Appendices should be labelled as A, B, etc. and the equations appearing in them be labelled as A1, A2, B1, B2, etc.

Proofs: Normally two sets of page-proofs are sent to authors for correction along with a reprint order form. One set of corrected proofs should be posted back to the Editorial Office within two days of receipt. If the corrected proofs are not received within a reasonable time, it will be presumed that the authors have no corrections to make.

The articles are typeset by computer photocomposition and printed by the offset process. While this process is neat, it makes corrections at the proof stage very difficult and expensive. Addition or deletion of a letter or a word or a sentence in the proof means resetting the whole line or para and sometimes even a few pages. Authors are therefore requested to indicate only typographical or composing errors. Fresh corrections which are absolutely essential and unavoidable can be indicated on the proof but will be charged to the authors at actuals.

Reprints: Fifty reprints of each article will be supplied free of charge. If additional reprints are desired these can be ordered at the proof stage at the cost indicated in the reprint order form.

The authors' attention is specially drawn to the instructions on items below. If these are not followed strictly, both the quality of reproduction and the technical accuracy would be jeopardised. Therefore, in such cases the manuscripts may have to be returned to the authors for improvement causing delays in their publication.

References: References should be numbered in order of appearance in the text of the paper, the number being enclosed in square brackets in the same line. e.g. "It has been shown [1, 2] that..." or "Ramachandran and Raman [14] developed a formalism in 1955 which made it possible..."

The second example is meant to show that while names of authors and dates are not essential, they can be included even in this format. At the end of the manuscript, references to articles in journals should be listed by number, again in square brackets, followed by authors names (preceded by initials), abbreviated journal title, volume, first page number and year in brackets, e.g.

[4] P W Anderson, *Phys. Rev.* **109**, 1492 (1958)

References to books should include: name(s) of author(s) (preceded by initials), title of the book, edition if not the first, initials and name(s) of editor(s) if any, preceded by "edited by" and publisher, place of publication, year within brackets and chapter or pages referred to, e.g.

[12] J de Boer and J Eichler, in *Advances in nuclear physics* edited by M Baranger and E Vogt (Plenum, New York, 1968) Vol. 1, p. 1.

References to theses must include the title of the thesis, the degree for which submitted, the University and year.

Mathematical Material: Equations must be clearly written, each on its own line, well away from the text. All equations must be numbered consecutively in Arabic numerals with the number in parentheses near the right hand margin. If desired, equations can be numbered consecutively in each section preceded by a point and the section number e.g. (3.14) for the 14th equation in section 3. Indices, subscripts, superscripts and exponents must be clearly indicated in pencil in one copy of the manuscript, for example like $a_{\wedge}$, $b_{\vee}$, $b^{a\vee}$, $b_{x\wedge}$... etc. 'Oh' and 'zero', K, k and Kappa, 'ell' and 'one', etc. must be clearly distinguished. Authors must indicate wherever special characters (Greek, Gothic, script, scalar, vector, tensor, matrix, etc) are required. All other letters will be set in italic type. Vectors must be underlined by a wavy line and tensors and matrices by two wavy lines. The SI system of units and symbols is recommended.

Figure: All figures, including photographs (which must be glossy prints) should be numbered consecutively in Arabic numerals in the order of occurrence in the text. Figure captions must be typed on a separate sheet.

Line drawings must be in Indian ink on good quality tracing paper. Curves should be drawn sufficiently thick to permit reduction to one half or even one third of the original size. The axes and letterings must be about 0.3 mm thick and curves 0.6 mm thick. Whenever computer outputs are directly submitted as figures, they should conform to the same specifications given earlier for drawings.